Reputation-Building with Heterogeneous Audiences

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Reputation-building with heterogeneous audiences

- cf Common agency; Bernheim and Whinston ‘86, Martimort ‘07
- Heterogeneous preferences (and information?)
  - Horizontal differentiation
  - Vertical differentiation
  - Issuers/investors (certification) Bouvard-Levy ‘11, Frenkel ‘11
  - Financiers and product market rivals; Gertner, Gibbons, Scharfstein ‘88
  - Political constituencies
  - Shareholders and unions
  - Managing up and down
  - Community and Employers (Austen-Smith and Fryer ‘05)
- Homogeneous underlying preferences but different information
  - Old/new customers

Plan for the talk: report on 3 loosely related models (all joint work with Joyee Deb)

- Two period career-concerns
  - Heterogeneous audiences as micro-foundation for “shape of reputation”: implications of shape
- Serving two audiences with opposed preferences
  - Same vs different observation and implications
- Many audiences with homogeneous preferences but different beliefs
  - Optimal client mix

The Takeaways

- Reputation for heterogeneous audiences is “different”
  – Cannot just add up individual reputation effects
  – Non-monotonic effect of reputation
- New question: Who sees what?
  – Can change the effect of reputation (ave per-period payoff as compared to one-shot) from “good” to “bad”
- New strategic implications
  – Strategy reversals
  – What information to whom?
  – Who to serve?

MODEL I: ONE PERIOD CAREER CONCERNS WITH GENERAL REWARDS

Heterogeneous Audiences

Micro-Foundation for Reputation as “Implicit Contract” with general (non-monotonic) form

Model 1: Riff on (1-period version of) Holmstrom (1982/99)

Agent of type θ; **Common** prior that ϑ is normally distributed with mean μ and precision h ($=1/\sigma^2$)

1. Agent privately takes an action a at cost $\frac{1}{2}a^2$
   - Outcome $s=\theta+a+\varepsilon$ observed, where ε is standard normal (mean 0, precision 1)
   - Beliefs updated according to Bayes' rule
2. Audience pays agent $R(E[\theta|s])$

Benchmark $R(x)=x$ then a^* is constant in μ and decreasing in h

General R(.)

$$c'(a^*) = \frac{1}{1+h}\int R'\left(\mu + \frac{x}{\sqrt{h(1+h)}}\right)\varphi(x)dx$$

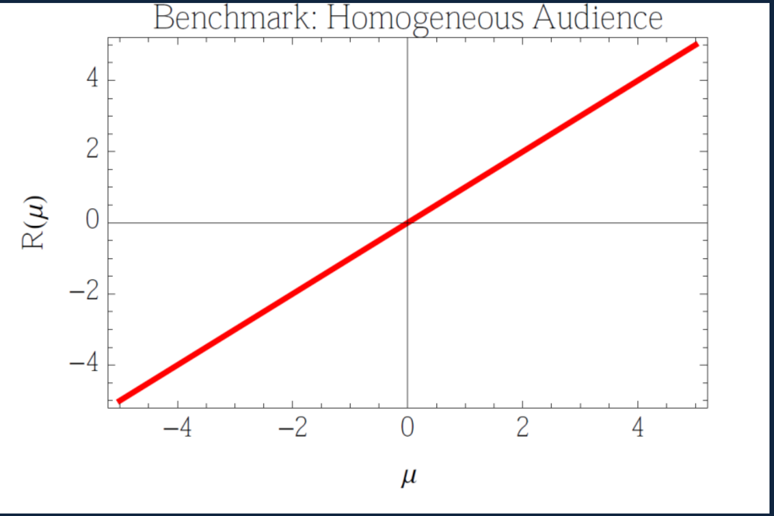
$$\frac{da^*}{d\mu} = \frac{1}{c''(a^*)}\frac{1}{1+h}\int R''\left(\mu + \frac{x}{\sqrt{h(1+h)}}\right)\varphi(x)dx$$

$$\frac{da^*}{dh} = \frac{1}{c''(a^*)}\frac{1}{1+h}\left[c'(a^*) + \int R''\left(\mu + \frac{x}{\sqrt{h(1+h)}}\right)\frac{x}{2}\frac{2h+1}{(h(h+1))^{3/2}}\varphi(x)dx\right]$$

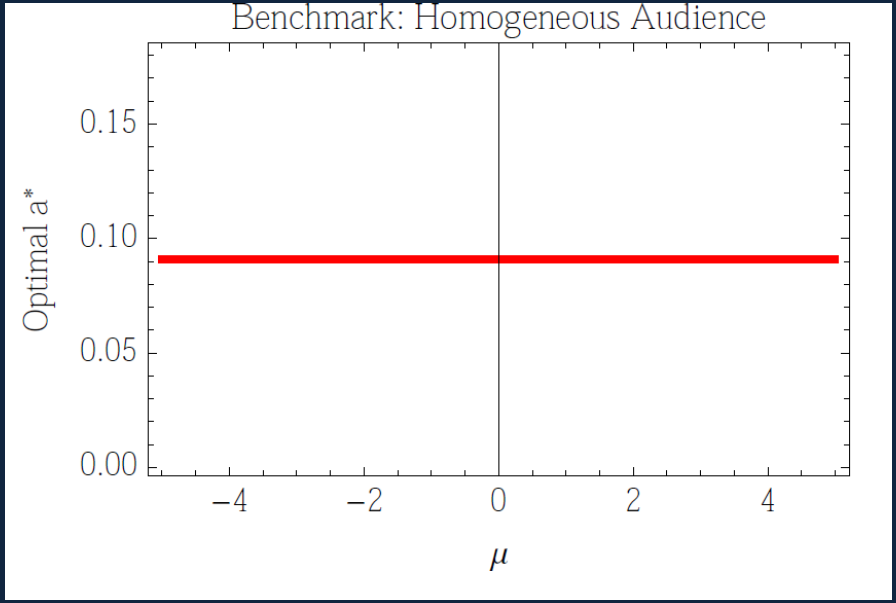
- Optimal effort depends on μ, can be increasing (e.g. R(.) convex) or decreasing
- Optimal effort need not be monotonic in h

Holmstrom Benchmark

Reward Function



Equilibrium Effort



Multiple audiences and R(.)

- Horizontal Reputation

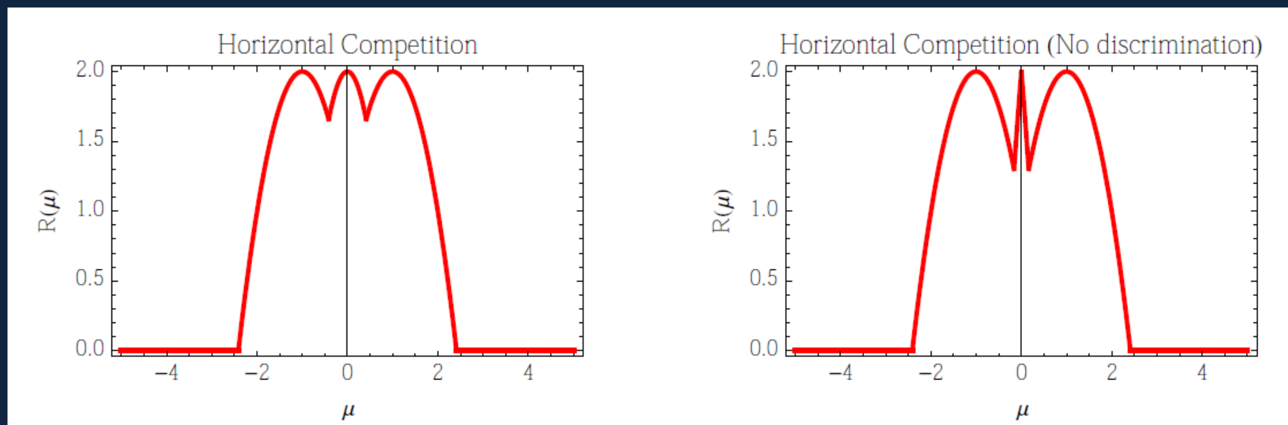
Customers either end of line, quadratic transport costs; firm type is location

A. Perfect price discrimination

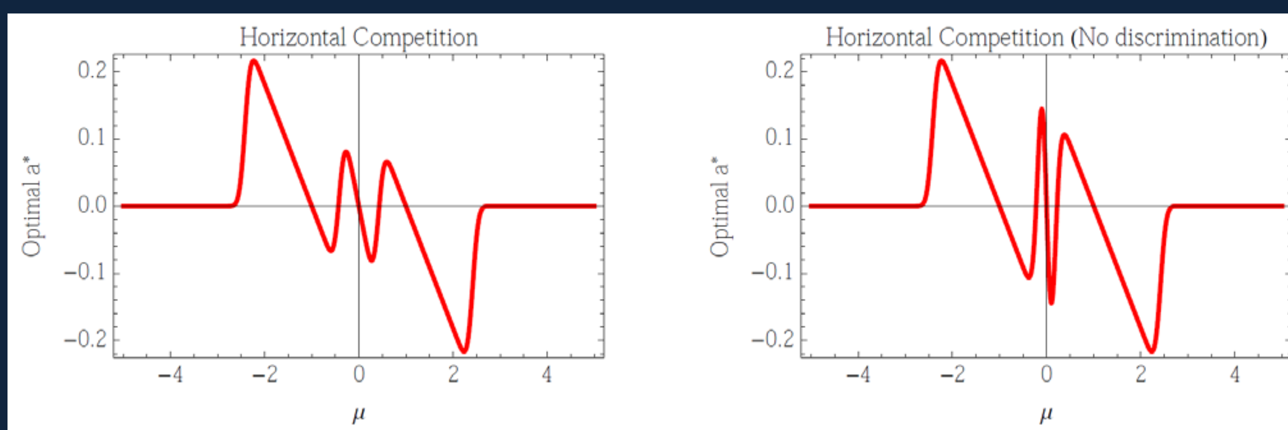
B. Same price to both

Horizontal Competition

Reward Function

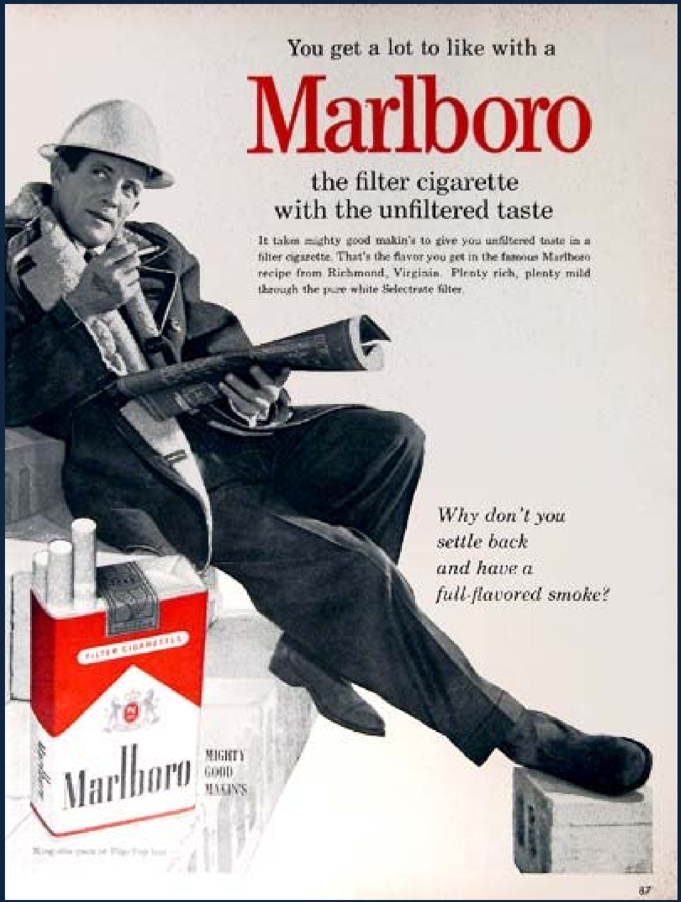


Equilibrium Effort



Strategy Reversals?

1950 Marlboro Ad



1962 Marlboro Ad

Multiple audiences and R(.)

- Vertical Reputation against incumbent of known type

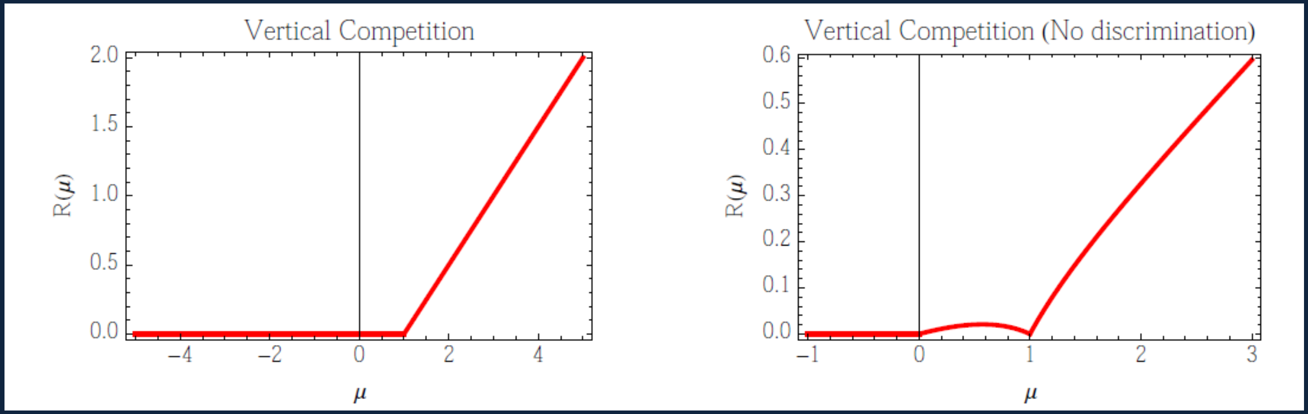
Customers uniform on $t \sim U[0,1]$ with utility $tE(\vartheta)-p$

A. Perfect price discrimination (monotonic reward)

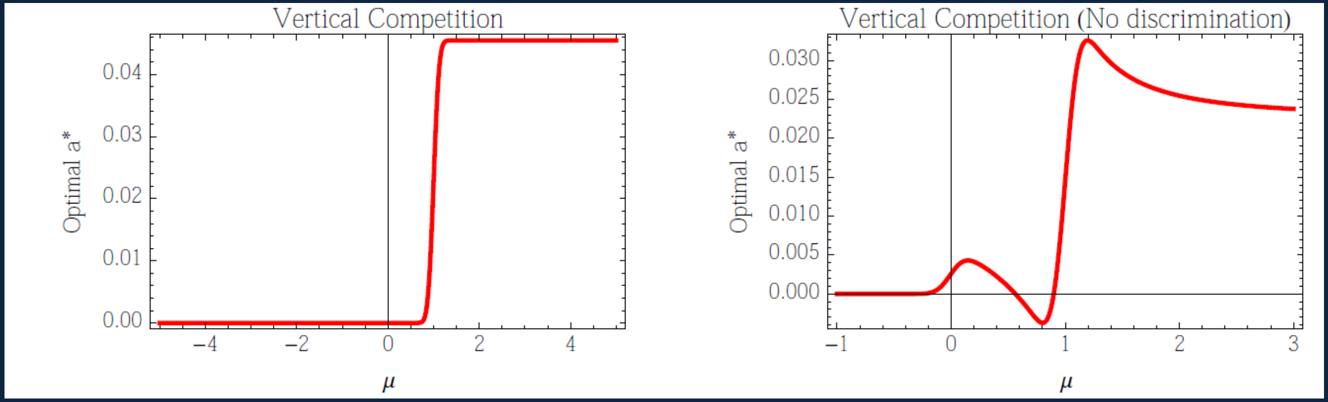
B. Same price to both

Vertical Competition

Reward Function



Equilibrium Effort



Strategy Reversals

1940: *This is about the time that color began to be used in print adverts. Similar to the previous two marketing angles**, this advert is angled at proving that Pabst is a quality product**. This one takes it a bit further by saying that this beer is distinct and its qualities are unique. So much so that, while drinking Pabst blindfolded you could make the distinction between PBR and its competitors.*

1942: *This is the beginning of Pabst's campaigning on the fact that its beer is a blend of 33 different brews that are aggregated into one ultra brew. **It is also a marked change in advertisements, going from marketing PBR as a luxury or high-end product to one that is now inclusive of the everyman. Rather than saying, "drink our beer and be classy', they were saying, "this beer is good for you just how you are."** Or rather than this beer being advertised as a class symbol, it is now a sign of light-hearted fun and amusement.*

Career Concern Takeaways

- No simple aggregation of reputation to individual audiences
- Optimal reputation may be interior
  - cf Gertner, Gibbons, Sharfstein (1988); Frenkel (2012); Bouvard and Levy (2012)
- Optimal action depends on current reputation
  - cf Chevalier and Ellison (1999), Hong, Kubik and Solomon (2000) Hong and Kubik (2003)
  - And may even switch with current reputation
- Non-monotonic effect of precision
  - cf Martinez (2010), Casas-Arce (2010), Kovrijnykh (2007)

MODEL II: REPUTATION FOR A SERVANT OF TWO MASTERS

Two Audiences with **Opposite preferences**

Separate vs common reputations and necessity of "bad" reputation

Model 2: Reputation for a Servant of Two Masters

- Agent type $\theta \in \{\theta_L, \theta_R\}$
- Agent knows own type
- Two L,R audiences share belief λ_0 that agent is θ_L –type

Infinite repetition of the following

1. L and R pay expected value of both actions
2. Agent chooses $(a^1, a^2) \in \{a_L, a_M, a_R\} \times \{a_L, a_M, a_R\}$
3. Observation
   – *Separate Observation*: L-audience observes a^1 and L-audience observes a^2
   – *Common Observation*: both audiences observes (a^1, a^2)
4. Beliefs updated to λ^L_{t+1}, λ^R_{t+1} (separate) or λ_{t+1} (common)

Payoffs I: Receipts from audiences

Audiences have opposed preferences, are risk neutral and their names are suggestive

- $w_L(a_L)=w_R(a_R)=1$
- $w_L(a_M)=w_R(a_M)=m\in(0,1)$
- $w_L(a_R)=w_R(a_L)=0$

- Care about both actions similarly
  - $w_A(a^1,a^2)=w_A(a^1)+w_A(a^2)$

Payoffs II: Agent Utility

- Costless to do your own thing, costly to do other, moderate to compromise
  - $c(a_L|\theta_L) = c(a_R|\theta_R) = 0$
  - $c(a_M|\theta_L) = c(a_M|\theta_R) = c > 0$
  - $c(a_R|\theta_L) = c(a_L|\theta_R) = C > c$
- Agent's per-period payoff when L anticipates (a^1_L, a^2_L), R anticipates (a^1_R, a^2_R) and agent actually chooses (a^1, a^2) is:

$$w_L(a^1_L)+w_L(a^2_L)+w_R(a^1_R)+w_R(a^2_R)-c(a^1|\theta)-c(a^2|\theta)$$

- Agent discounts at δ and maximizes lifetime utility

Equilibrium concept

- Markov Perfect equilibrium taking state as
  - Under common observation: λ
  - Under separate observation: λ^L, λ^R
  - At degenerate beliefs then only costless actions
- Off-equilibrium
  - Forward induction where relevant: if a_M anticipated and a_L observed then set $\lambda=1$
  - Off-path updating to degenerate
- Higher order beliefs in principle could matter: L's beliefs about R's beliefs might be relevant for figuring out likely behaviour
- Restrict attention to pure strategies
  - No scope for higher order beliefs
  - Along path updating trivial

Results

Equilibrium Type	θ_L-agent plays	θ_R-agent plays	Per-period Expected Payoffs	Separate Observations	Common Observations
Full Separation (No reputation)	(a_L, a_L)	(a_R, a_R)	2	$C \geq \frac{2\delta}{1-\delta}$	Always Exists
Full Compromise	(a_M, a_M)	(a_M, a_M)	4m-2c	X	$\delta(2m-1) \geq c$
Catering and Compromise	(a_M, a_R)	(a_M, a_R)	$\theta_L : 2m+1-c-C$ $\theta_R : 2m+1-c$	X	$\delta(2m-1) \geq c+C$
	(a_L, a_M)	(a_L, a_M)	$\theta_L : 2m+1-c$ $\theta_R : 2m+1-c-C$	X	$\delta(2m-1) \geq c+C$
Catering to both audiences	(a_L, a_R)	(a_L, a_R)	$2-C$	$\delta \geq C$	X
Catering and Separation	(a_L, a_R)	(a_R, a_R)	$\theta_L : 2-C$ $\theta_R : 2$	$\delta(2-\lambda) \geq C \geq \frac{\delta}{1-\delta}$	X
	(a_L, a_L)	(a_L, a_R)	$\theta_L : 2$ $\theta_R : 2-C$	$\delta(1+\lambda) \geq C \geq \frac{\delta}{1-\delta}$	X

Notes

- Under separate observation; **highest** per-period payoff is when reputation has no effect (only take costless action)
  - Reputation is "GOOD"
- Under common observation; **lowest** per-period payoff is when reputation has no effect (only take costless action)
  - Reputation is "BAD"

Discussion

- Immediate that common observation preferred, and would choose common rather than separate if feasible

- Again, interior reputation can be optimal: leads to efficient compromise

Intuitions

Under separate observation:

- Tempting to cater to each audience
- No benefit since audiences have opposed preferences
- Costly to cater
  - ➢ Worse off overall
- No way to credibly commit to “behaving” on actions that the audience does not see

Under common observation

- Everything out in the open
- If exert no effort, EVERYONE sees it
- So equilibrium payoff must be bounded below by no effort outcome

Discussion II

- Payoff under separate can be worse than one-shot interaction, never better: “bad reputation”
  - Commitment types need not reverse this
  - cf Fudenberg-Levine (1989)
  - cf Ely-Valimaki (2003)

MODEL III: REPUTATION AND THE CLIENT MIX

Audiences homogeneous in preferences
Heterogeneous in information (through experience)
Less-informed clients as commitment to effort
Optimal client mix

Model 3 Client Mix

- If client mix is observed then choice of client mix can act as commitment
  - Who the agent serves affects reputational incentives; so choice of who to serve signals likely behaviour
- Client mix needs commitment to valued effort in order to milk clients with high opinion of type

Reputation and Client Mix

- Model where audiences have homogeneous preferences but through experience different beliefs
- Patronage (do clients come back? public client lists/informal rumor) commonly observed but outcomes (and prices) are not (or at least not as well)
- If only serve young clients then limited repn effects and no one expects effort
- Repn effects with old clients diminish (less to prove)
- Trade-off between “milking” clients who have high degree of confidence and investing in commitment through serving inexperienced clients

Model

- Agent type $\theta \in \{b, g\}$
  - b always fails
  - g can exert effort at cost c and raise probability of success to γ (iid on projects)
- All customers value success at 1 and failure at 0
- In each period a continuum, unit mass enters and lives for $N \geq 2$ periods
- Firm has limited capacity and decides how to allocate time by cohort (but serves all within cohort)
- Firm maximizes lifetime value, discounting at δ

Timing within a period

1. Firm publicly offers allocation of time $\{\alpha(n)\}$ to each cohort n and privately offers prices where $\alpha(n) > 0$ and $\sum_{n=0}^{N-1} \alpha(n) \leq 1$.
2. Customers accept/reject offer
3. If firm is good then chooses whether or not to exert effort (**Single decision**)
4. Outcomes privately observed

MPE: potentially complicated state; but continuum within each cohort so state evolves deterministically given effort

Analysis

- Benchmark: Observable outcomes then no effort
- In model (outcomes unobservable): there always exists a no-effort equilibrium

Consider steady state in pure strategy equilibrium with effort then the following beliefs arise:

- All $n=0$ customers assign belief λ that agent is good
- Fraction $(1- \gamma)^n$ of cohort n customers have only seen failures and assign belief $\lambda^f(n)$ that agent is good,
- Remaining $1- (1- \gamma)^n$ of cohort n have seen success and assign probability 1 to agent being good

Analysis II

Consider steady state in pure strategy equilibrium with effort: Time allocation {α(n)} same for good and bad types, and satisfies

$$c \leq \gamma\delta^2 \sum_{n=1}^{N-1} \left\{ (1-\gamma)^{n-1} \frac{(1-\delta)^{n-1}}{1-\delta} \frac{1-\lambda}{\lambda(1-\gamma)^{n-1}+1-\lambda} \right\} \alpha(n)$$

The per-period value for the good type is

$$\alpha(0)\lambda\gamma + \gamma \sum_{n=1}^{N-1} \left[\frac{1-\lambda+(1-\gamma)^{n-1}(2\lambda-1)}{\lambda(1-\gamma)^{n-1}+1-\lambda} \right] \alpha(n)$$

Milking vs commitment trade-off observed from noting that [ ] increases in n but { } must decrease somewhere since in the limit

$$(1-\gamma)^{n-1} \frac{(1-\delta)^{n-1}}{1-\delta} \frac{1-\lambda}{\lambda(1-\gamma)^{n-1}+1-\lambda} \to 0$$

In case N=2, milking and incentives go together, more generally (as demonstrated above, and analytically with N=3) there is a real trade-off

CONCLUSIONS

Summary: new questions/insights

1. (How) Does reputation-building look different with heterogeneous audiences?
   - Not so obvious what makes for “good” reputation
   - Adding up effects from each audience separately often inappropriate
2. What happens when different audiences see different things?
   - Possibility of bad reputation
3. Which audience to serve?
   - Client mix as commitment
   - Optimal mix trades-off commitment incentive and milking incentive

Applied/Strategy/Empirical implications

1. Identifying reputation effects might be tricky
2. Transparency with multiple audiences
3. Turning customers away to enhance value